C.R. Bard, Mass Balance Calculations for Toxic Release Inventory (TRI) Form R

Facility: Madison, GA **Use this to report 2018**

Reporting year: 2018

	All non 14, 34, 44		Cycle 14, 34, 44		Total
Input data requiring annual					
Quantity of bad drums	1	Obtain this from operations / purchasing personnel	0		1
Weight in partial drums	0 lb	Obtain this from operations / purchasing personnel	0 lb		0
Ethylene oxide	198,952 lb/yr	Obtain this from operations / purchasing personnel	25,769 lb/yr		224,721
Number of Cycles (Cycle 7, 12, 26, 28,	1,934	Obtain this from operations personnel	0		1,934
Number of Cycles (Cycle 8, 14, 34, 44,	19	Obtain this from operations personnel	465		484
Input data to review, but may not have					
EO accidental release,	0 lb	Update only if there was an accidental release of EO	0 lb		0
EO accidental release,	0 lb	Update only if there was an accidental release of EO	0 lb		0
Sterilizer removal efficency	99.1%	Update only if an efficiency Performance Test was performed during the year, per Air Quality Permit Section 7	99.1%		
RTO efficency,	99.73%		99.73%		
RTO efficency,	99.99950%		#######		
Product transfer time, sterilizer	5 min	Update only if there have been changes to process durations during the year	5 min		
Aeration time, Cycle	17 hr		18 hr		
Aeration	20 hr		18 hr		

Unload		30 min			30 min	
Online report						
Form R	Form R section	Value to enter			Value to enter	
Section 5.1	Fugitive or Non-Point Air Emissions	381.9 lb		Used these number over there>>>>>>	172.1 lb	554.0
Section 5.2	Stack or Point Air	2.1 lb			1.1 lb	3.2
Section 5.4.1	On-site Underground Injection: Class I Wells	N/A			N/A	
Section 5.4.2	On-site Underground Injection: Class II-V	N/A			N/A	
Section	On-site Landfills: RCRA	N/A			N/A	
Section	On-site Landfills: Other	N/A			N/A	
Section 5.5.2	On-site Land Treatment and	N/A			N/A	
Section 5.5.3A	On-site Surface Impoundments: RCRA	N/A			N/A	
Section 5.5.3B	On-site Surface Impoundments: Other	N/A			N/A	
Section	Other Disposal	N/A			N/A	
Section 5.3	Water Bodies	N/A			N/A	
Section 6.1	POTW	N/A			N/A	
Section 6.2	Company that receives returned drums	BALCHEM CORP			BALCHEM CORP	
	Total quantity (lb)	4,376.0			512.0	4,888.0
	Basis of estimate	C - Mass balance			C - Mass balance	
	Waste Management Type	M26 - Other Reuse or Recovery			M26 - Other Reuse or Recovery	
Section 7A	On-site Waste Treatment Methods and Efficiency	RTO Desctruction of EO			RTO Desctruction of EO	
	Waste treatment	99.9%			99.9%	
Section 7B	On-site Energy Recovery Methods and On-site Recycling	N/A			N/A	
Section 7C	Methods and Quantity	N/A			N/A	
Section 8.8	Non-Production	No			No	
Section 8.1a	Total On-site Disposal to Wells or Landfills	N/A		For future reporting years, click the "Use Current Year	N/A	
Section 8.1b	Total Other On-site Disposal or Other	384.0 lb			173.1 lb	557.1
Section 8.1c	Total Off-site Disposal to Wells or Landfills	N/A			N/A	

Section 8.1d	Total Other Off-site Disposal or Other	N/A			N/A		
Section 8.2	Quantity Used for Energy Recovery On-	N/A			N/A		
Section 8.3	Quantity Used for Energy Recovery Off-	N/A			N/A		
Section 8.4	Quantity Recycled On-	N/A			N/A		
Section 8.5	Quantity Recycled Off-	4,376.0	lb		512.0	lb	4,888.0
Section 8.6	Quantity Treated On-	198,568.0	lb		25,595.9	lb	224,163.9
Section 8.7	Quantity Treated Off-	N/A			N/A		
Section 8.9	Production Ratio or	0.95			#DIV/0!		
Section	Source Reduction	N/A			N/A		
	Barriers to Source	B7			B7		
Section 8.11	Optional Pollution Prevention Information	Can leave all blank			Can leave all blank		
Section 9.1	Miscellaneous Information	Can leave all blank			Can leave all blank		
Assumptions:							
	EtO returned in each used drum	8.0	lb/drum	Initial weight (400 lb) - tare weight (18 lb) + manifold weight (10 lb) = 392 used per drum. Therefore, 8	8.0	lb/drum	
	Product absorbtion	0.4%		Frank Davis memo Subject Ethylene Oxide, 9.apr.2019	2%		
	EO degassing rate	0.06151	lb/hr	Frank Davis memo Subject Ethylene Oxide, 9/25/08	0.06151	lb/hr	
	Miscellaneous	100	lb		0	lb	100
Calculati							
	Process Total drums	497			64		561.0
	Returned in drum	3,976.0	lb		512.0	lb	4,488.0
	Returned in bad	400.0	lb		0.0	lb	400.0
	Returned in partial bad drums	0.0	lb		0.0	lb	0.0
	Total	4,376.0	lb		512.0	lb	4,888.0
	Sterilizer: EO into sterilizers	198,952	lb		25,769	lb	224,721.0
	EO absorbed	795.8	lb		515.4	lb	1,311.2

EO in sterilizer not	198,156.2	lb			25,253.6	lb	223,409.8
EO exhausted to RTO	196,372.8	lb			25,026.3	lb	221,399.1
EO exhausted to RTO	1,783.4	lb			227.3	lb	2,010.7
Sterilizer exhaust to RTO	198,156.2	lb			25,253.6	lb	223,409.8
Sterilizer exhaust removed by RTO	198,155.2	lb			25,253.5	lb	223,408.7
Sterilizer exhaust from RTO	1.0	lb			0.1	lb	1.1
Transfer:							
EO offgas during product transfer to aeration	0.51%		EO will off-gas from products during aeration per equation: $C = C_o e^{(-kt)}$, where C = Final EO concentration, C_o = EO concentration at time 0, k =		0.51%		
EO offgas during product transfer to aeration	4.1	lb			2.6	lb	6.7
Aeration:							
EO remaining in product entering	791.7	lb			512.7	lb	1,304.5
Offgas during aeration,	64.9%				67.0%		
Offgas during aeration,	70.8%				67.0%		
Offgas during	3.0%				3.0%		
EO offgas during aeration, Cycle 7	508.5	lb			0.0	lb	508.5
EO offgas during aeration, Cycle 8	5.5	lb			343.3	lb	348.7

EO offgas during aeration,	513.9 lb	343.3 lb	857.2
To RTO during	405.5 lb	338.2 lb	743.7
To RTO during	8.4 lb	5.1 lb	13.5
Total aeration	413.9 lb	343.3 lb	757.2
Aeration removed by RTO	412.8 lb	342.4 lb	755.2
Aeration exhaust	1.1 lb	0.9 lb	2.0
In			
EO in	277.8 lb	169.5 lb	447.3
Exhausted:			
EO exhausted to	2.1 lb	1.1 lb	3.2
Total removed	198,568.0 lb	25,595.9 lb	224,163.9
Total EO exhausted to	106.2 lb	3.7 lb	109.9

Production ratio:

	Historical gas loads	Production ratio	Production ratio
2006	60		
2007	545	9.08	#DIV/0!
2008	1087	1.99	#DIV/0!
2009	1162	1.07	#DIV/0!
2010	1697	1.46	#DIV/0!
2011	1760	1.04	#DIV/0!
2012	1620	0.92	#DIV/0!
2013	1264	0.78	#DIV/0!
2014	1820	1.44	#DIV/0!
2015	1753	0.96	#DIV/0!
2016	2065	1.18	#DIV/0!
2017	1,953	0.95	#DIV/0!
2018	2421	1.24	#DIV/0!
2019			
2020			